# Discharge Characteristics of AC-PDPs with a grooved front dielectric layer

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**Abstract**

*The influence of the grooved dielectric layer on discharge and luminous characteristics has been investigated for various depths of the groove to achieve a high luminance efficiency AC-PDP operated at a lower voltage. We use the voltage-threshold curve technique and address delay jitters to explain the discharge characteristics. It shows that the surface discharge voltage rely on the depth of the grooved dielectric layer. Vertical discharge voltage remains almost the same as the groove depth increases.*

## 1. Objectives and Background

AC-PDPs with high Xe content and long discharge gap have attracted considerable attention for high luminous efficiency. However the operating voltage increases and thus, the cost of circuit devices. Therefore it is necessary to find the AC-PDP cell structures or driving scheme to reduce the operating voltage in high Xe content and long discharge gap.

Recently, the structure with front dielectric layer thinner only around the electrode gap has been proposed for a high luminous efficiency [1,2,3] as shown in Fig 1.

In this paper, we investigated the characteristics of luminous efficiency, discharge voltage and address delay jitters with the depth of the grooved dielectric layer variation from 0 to 10㎛.

## 2. Experimentals

The design parameters of 7-inch diagonal size AC-PDPs are basically the same as those of a typical 42-inch XGA PDP. The discharge gas contains 14% of Xe in Ne host gas and total gas pressure is 500 Torr. The distance between the sustain electrodes is 60㎛ and the groove width is 160㎛. The depth of the grooved dielectric layer is varied from 0 to 10㎛. The fabrication process of the grooved dielectric layer is similar to the conventional fabrication process. Sustain frequency with 200 kHz and 8- subfields is applied for the luminance and efficiency measurement. The firing voltage of the surface and vertical discharge is investigated by utilizing the voltage threshold curve technique.

## 3. Results and Discussions

### 3.1 Influence of the groove depth on luminous efficiency

Fig 2 shows the measured efficiency and luminance as a function of the sustain voltage for various groove depth. We found that the luminous efficiency of the grooved structure is higher than that of conventional structure at mid-margin voltage. This is due to lower operating voltage.

Efficiency is the highest at the 5um-depth of the grooved structure (conventional: 1.69lm/W at 230V, 5㎛-groove: 1.91lm/W at 210V, 10㎛-groove: 1.74lm/W at 200V ). As the depth of the groove gets deeper than 5㎛, efficiency and luminance decrease because Deep grooved structure causes the confined discharge around the groove owing to the influence of the strong electric field within the groove.

### 3.2 Influence of the groove depth on luminance and current density

Fig 3 and Fig 4 show the measured luminance and current density as a function of the sustain voltage for various groove depth.

The luminance of the grooved structure is higher than that of conventional structure. but as the depth of the groove gets deeper than 5㎛, luminance quickly saturate causing by the confined discharge around the groove.

As the depth of the groove gets deeper, current density increases because of lowering thickness of dielectric layer within the groove.

### 3.2 Influence of the groove depth on discharge characteristics

Fig. 5 and Table 1 show firing voltages of the surface discharge and vertical discharge. Firing voltage of Surface discharge decreases for increasing the groove depth, but voltage of the vertical discharge remains almost the same as the groove depth increases. Because path of the surface discharge gets short and that of vertical discharge is same as the groove depth increases.

Address delay jitters get worse as increase a depth in shown Fig. 6 We assume that confined discharge of the groove structure affects the wall charge distribution. We need to study how groove structure affects on the wall charge distribution after reset.

## 4. Conclusions

We investigated how the groove depth affects on discharge and luminous characteristics. Results on discharge characteristics for various groove depths have been shown, which could be very useful in designing the grooved structure AC-PDP.

## 5. References


[1] J.S.Chung, U.S. Patent, US 6,326,727 (2001)

[2] Tokunaga Tsutomu et al., JP Patent, Publication JP283934 (1998)

[3] S. J. Yoon et al., IDW’04 , p945 (1998)


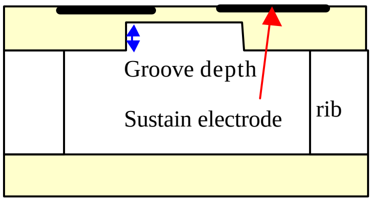


Figure 1 The schematic views of AC-PDP ; grooved front dielectric layer. The thickness of the dielectric layer is 35㎛ and groove width is 160㎛.

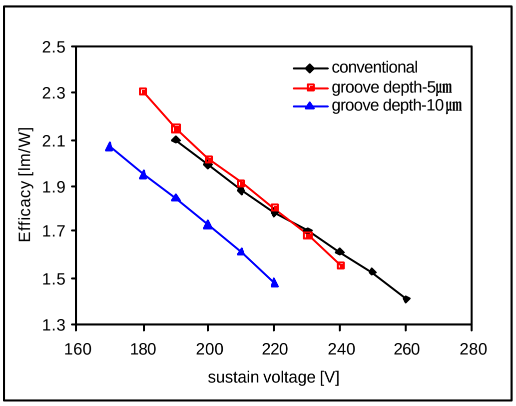


Figure 2 Efficacy as a function of sustain voltage for several groove depth

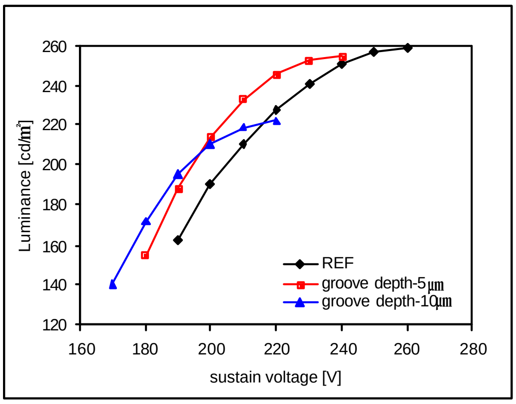


Figure 3 Luminance as a function of sustain voltage for several groove depth

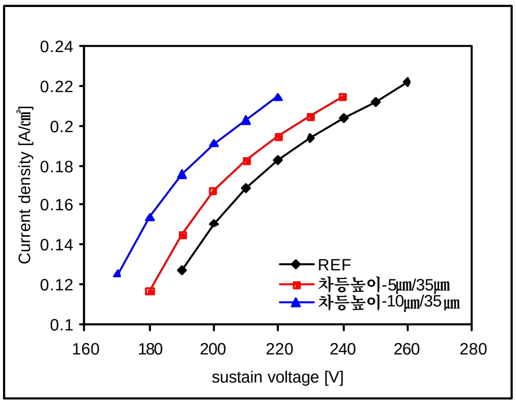


Figure 4 Current density as a function of sustain voltage for several groove depth

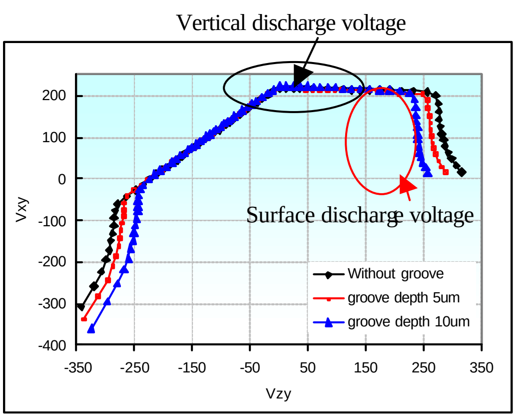


Figure 5 Voltage threshold curve as a function of sustain voltage

for several groove depth

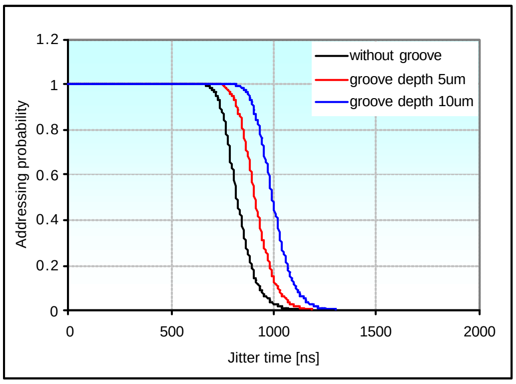


Figure 6 Address discharge jitters as a function of sustain voltage for several groove depth

Table I Comparison of discharge voltage for several groove depth

| Groove depth | 0㎛ | 5㎛ | 10㎛ |
|---|---|---|---|
| Surface discharge | 285V | 264V | 241V |
| Vertical discharge | 216V | 213V | 215V |